MVTX Work at BNL

MVTX Electronics Meeting

Zhaozhong Shi

07/13/2023

Summary of Progress

MVTX Decoder

- Jo implemented the stripping of the BUSY_ON, BUSY_OFF, and the APE error
  - Decode the whole Run 11 smoothly
- Yasser updated the decoder
  - Including the strobe information to all the hits
  - Strobe_id corresponds to the absolute time

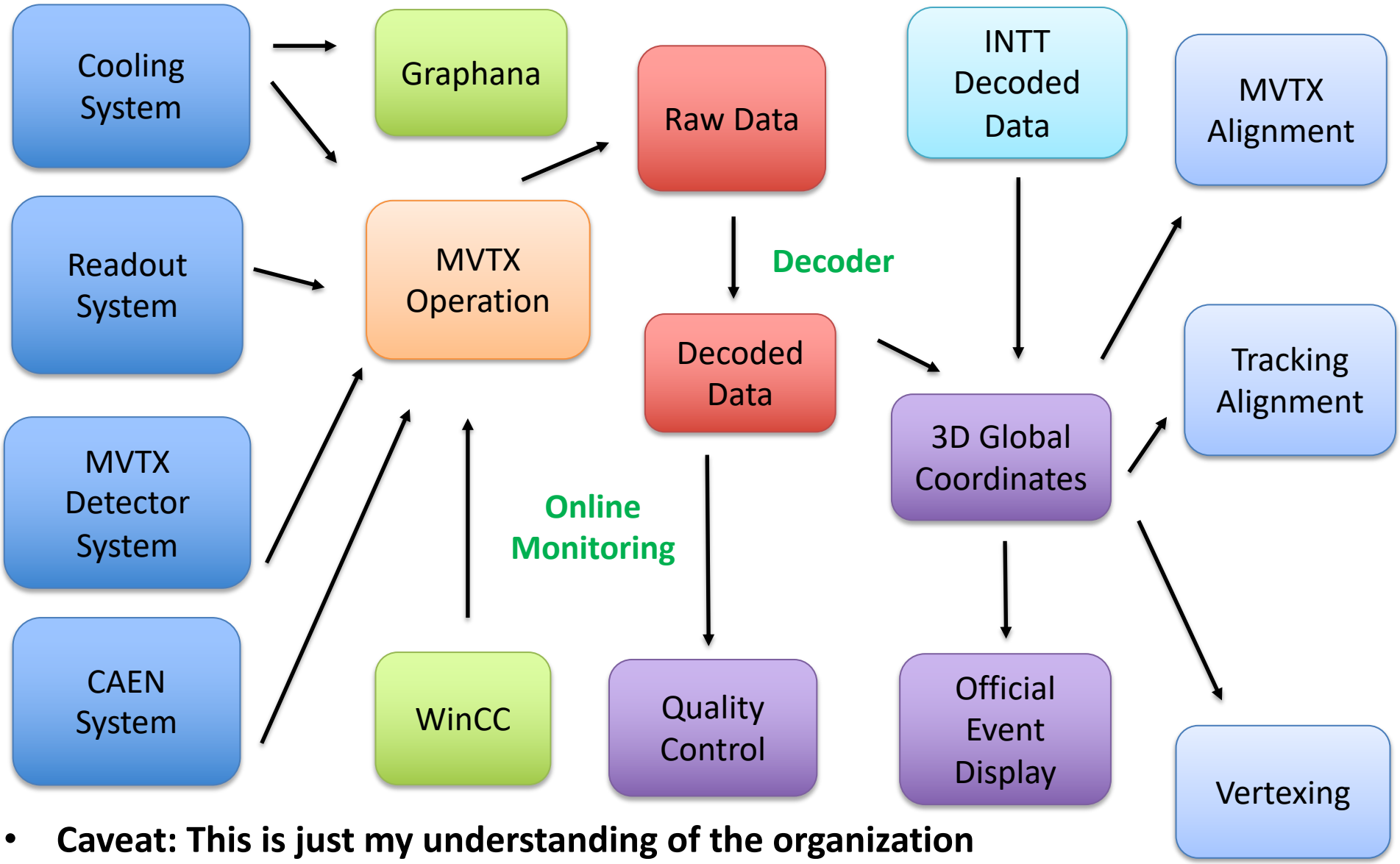
Detector Operation

- 1 continuous and 2 triggered modes runs taken on 07/11 (strobe length: 200 ns)
- Fixed cooling communication error on 07/13

Data Analysis

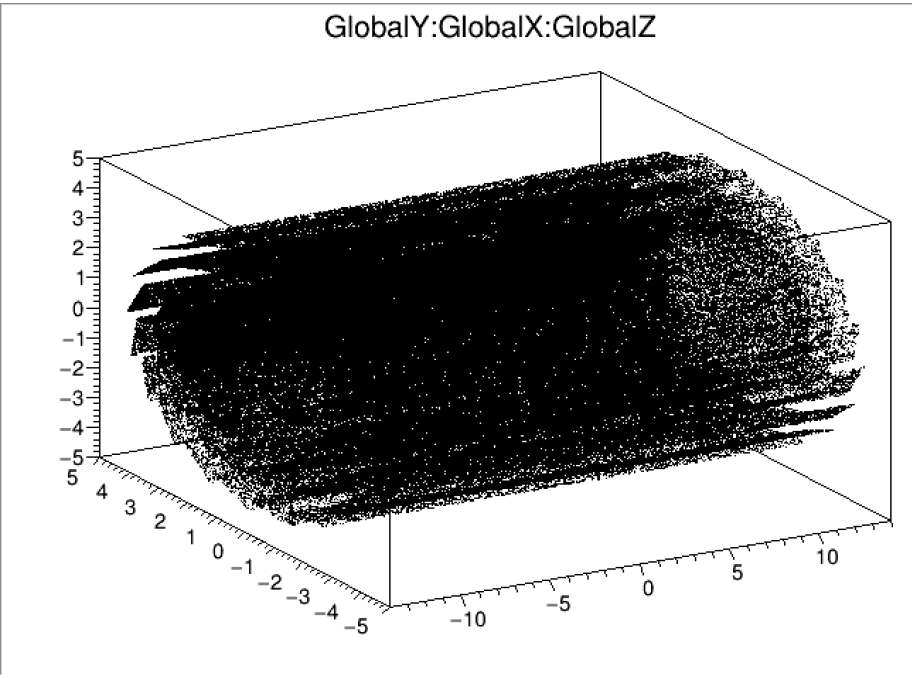
- Implementation to transform MVTX and INTT decoded data to 3D coordinates
- Plot MVTX 3D data to the official event display framework for visualization (credit to Hao-Ren

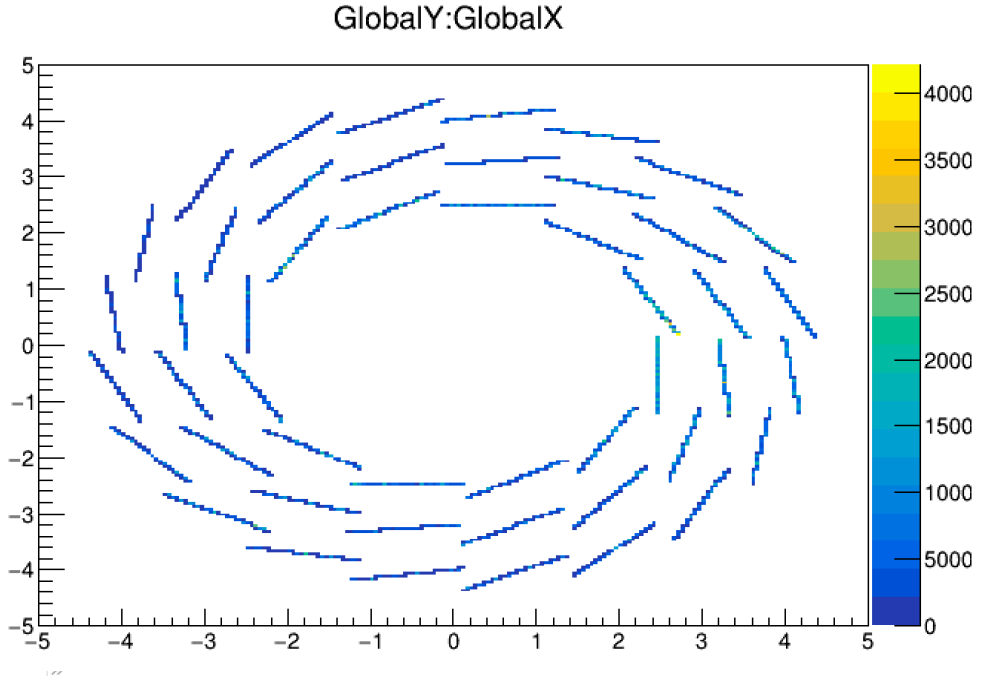
Overall Work Organization



- **Caveat: This is just my understanding of the organization**

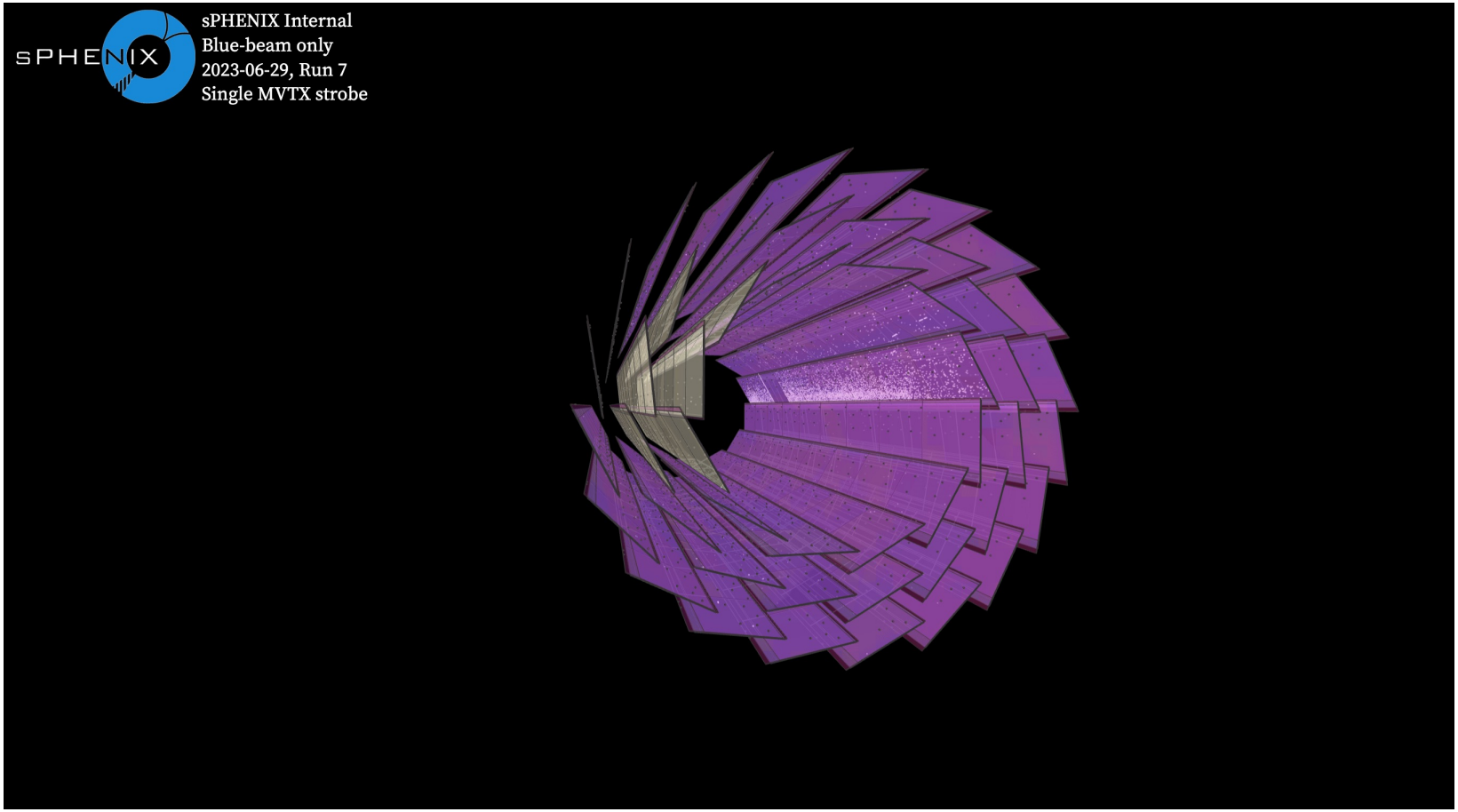
MVTX 3D Event Display (Run 7)





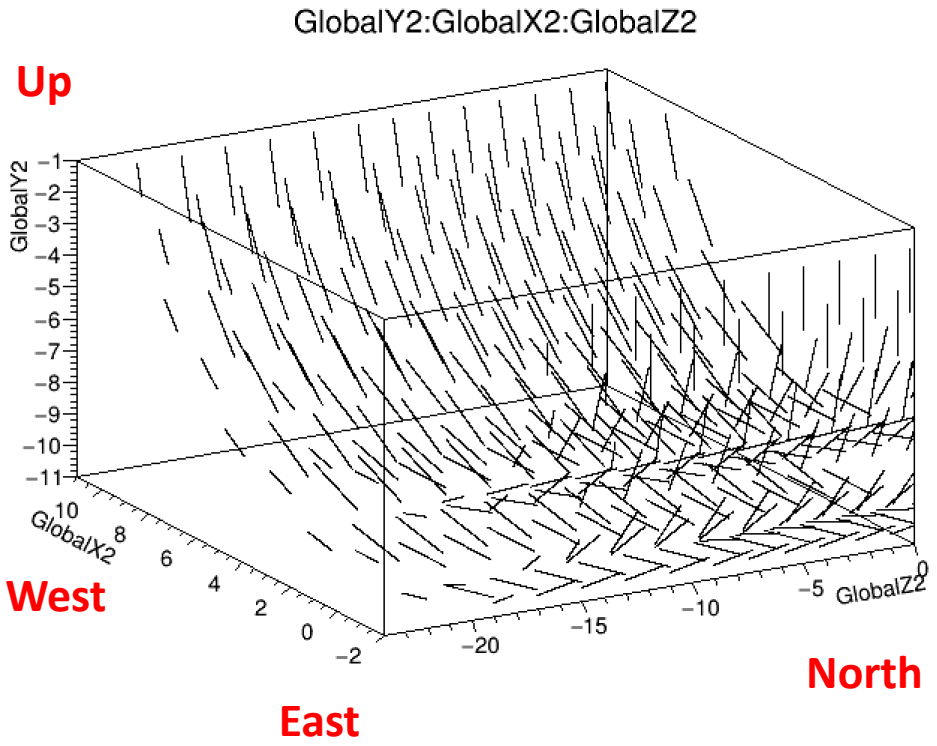
- Quickly copy Hao-Ren's codes in the new decoder to allow
- Quickly compare the new and old decode. Same results are seen
- Also include FELIX ID and Cable ID for all the staves
- Will look into a specific strobe to understand the MVTX data

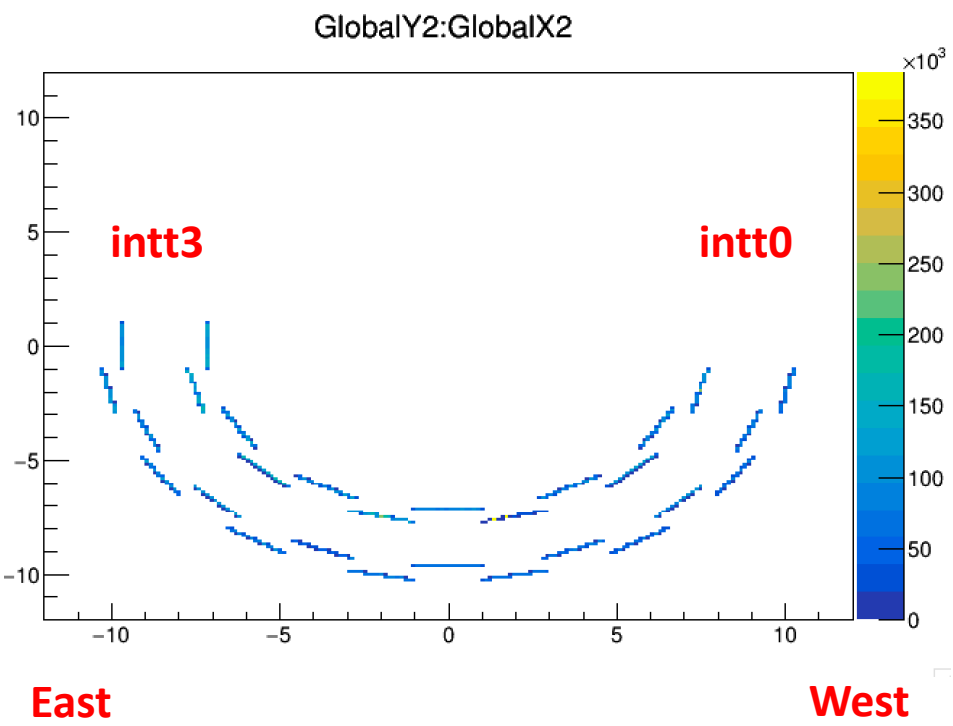
Official Event Display for MVTX



- Hao-Ren implemented the official event display for MVTX by importing the MVTX 3D global coordinates of the hits to the event display frame framework
- Possibly extend to INTT event display? (suggestion from Jin)

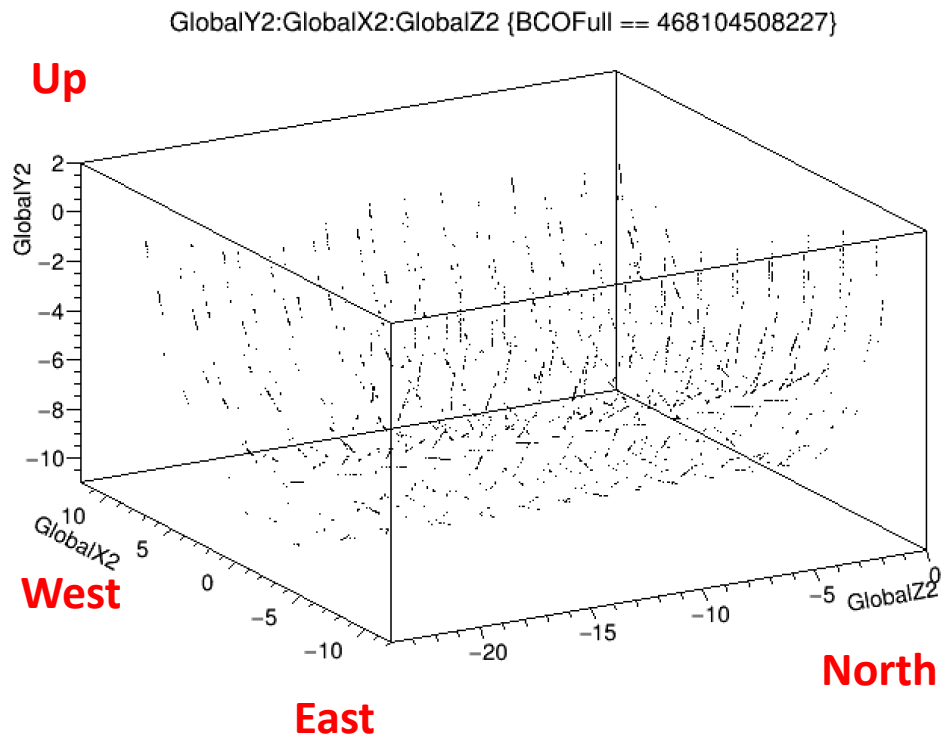
INTT Event Display for Run 20402

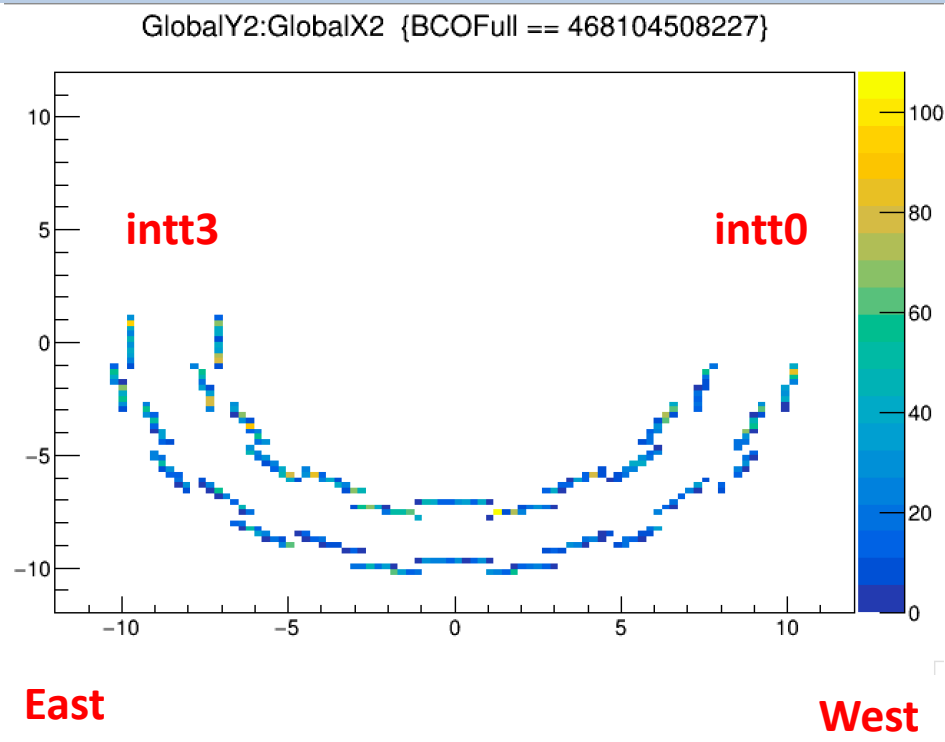




- Clear INTT 2 layers structure (barrel 0 and 1 are shown)
- Integrated hits for the whole run (about ~ 11 minutes)
- Output hits are manually rotated clockwise by 90 degrees
- Units are all in cm
- Thanks for the help from INTT team: Maya, Takashi, and Genki to make these plots

INTT 3D Display for A Given BCO





- Select BCO Full = for INTT Run 20402 for both intt0 and intt3
- Total hits = 7655
- Can combine MVTX and INTT within the same BCO time frame to perform sPHENIX inner silicon detector event display
  - Beneficial for detector alignment studies

To Do List

- Finish the analysis of the triggered data
  - Finalize the analysis workflow
  - Display “beam tracks” in 3D by requiring the strobe ID

- Possibly also include hits for INTT official event display
  - Consult INTT team to avoid overlap

- Correlate MVTX events with INTT events (Tracking Task Commissioning)
  - Beam background
  - Tracking alignment
  - Vertex determination

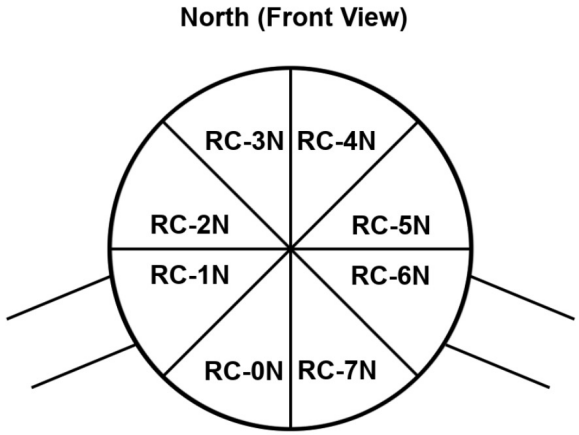
- Look at MBD data and plot them into 3D coordinate along with INTT hits
  - Better understand beam background
  - Correlate MVTX, INTT, and MBD eventually?

Back Up

INTT Data Analysis

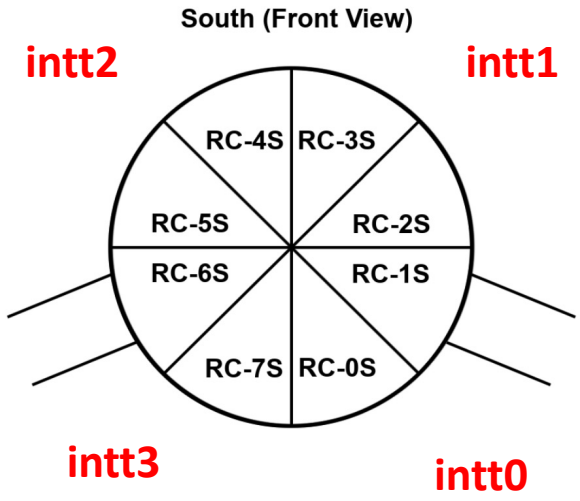
INTT Runs

- 2 blue beam runs in total: Run 20402 and Run 20403, with MBD triggers, right after the MVTX beam background study runs
- Readout: FELIX 0 and 3 (intt0 and intt3)
  - Location: south half barrel and bottom east and west quadrant
  - https://wiki.sphenix.bnl.gov/index.php/INTT_Barrel



INTT Data Content

- Event-by-Event structure
- 1 event has 1 bco.full and multiple bcos for its hits
  - Within the event, the smallest BCO value is the beginning of the hits
  - BCO monotonically increases event-by-event
  - Difference in BCO to time: 1 BCO = 106 ns
- Barrel is actually layer with two layers inside
- Layer ID in sim = barrel * 2 + layer + 3



Commands to Produce the Plots

- Get the codes by **git clone https://github.com/MYOMAO/MVTXINTTEvtDisplay.git**
- Build the code by **source Build.sh** for cshell and **source BuildBshell.sh** for bash shell
- Set the detector type to run at https://github.com/MYOMAO/MVTXINTTEvtDisplay/blob/master/macros/common/G4_Input.C#L48
  - DetectorType = 0 is MVTX
  - DetectorType = 1 is INTT
- Define the Filelist to run. **MVTX: FileList.txt** and **INTT: INTTFileList.txt**
- Output file stored **at OutFile/MVTX** and **OutFile/INTT**
- Also attach written in README.md file also in the repository